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Short Research Communication

Impact of secondary stressors on urban and rural communities affected by repeated flooding and the potential resulting health implications: A pilot study

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Secondary stressors can be defined as ongoing, unresolved factors, indirectly associated with a defined prior event or events, resulting in emotional strain among affected individuals and acting as obstacles in a return to what is perceived as normality. An example is the complications relating to flood repair works. An important gap in flood research to date is studying the impact of secondary stressors specifically on flood victims and on different types of communities, for example urban and rural areas. **Methods:** Semi-structured interviews and the completion of a subsequent questionnaire with residents from urban and rural areas affected by reoccurring flood events. **Results:** Key secondary stressors included damage to property and possessions, repair works, fear of reoccurring flooding and lack of confidence in or help from agencies. Half of the participants achieved an Impact of Event score which indicated they had at least some of the symptoms of post-traumatic stress disorder (PTSD), with 4 residents obtaining a score above the cut-off point for a probable diagnosis of PTSD. **Discussion:** Residents who have experienced reoccurring flooding are affected by multiple stressors simultaneously, thus expedient settlement of resolvable issues such as insurance claims cannot be underestimated as it minimises the extent of stress placed on those affected. It is essential to conclude which secondary stressors have the most detrimental impact on residents, as they are the stressors most likely to contribute to flood related health conditions and may require support to resolve. Future quantitative work will determine if communities with different geographical locations experience similar stressors.

Key words: Flooding, secondary stressors, health, flood risk, urban, rural.

INTRODUCTION

Recent statistics demonstrate that floods remain the principal cause of major disaster mortalities worldwide, contributing to 44% of deaths in 2013 (IFRC, 2014). Flood events have significant economic, environmental and social implications, both in regions affected by extensive flooding and at a community level where minor floods still have potentially large cumulative effects (Few and Matthies, 2006). The continuing dominance of flood events at a global level intensifies the research rationale for studying flood

related health impacts, in order to both quantify long term health consequences and estimate the recovery rate for flood affected individuals and communities (Bich et al., 2011; Joseph et al., 2011; Kirsch et al., 2012; Tunstall et al., 2006).

The focus of the majority of health related flood research to date has remained on either the immediate physical impacts of flooding, such as injuries and diseases, or mental health disorders, including post-traumatic stress disorder,



Figure 1: Urban and rural study locations

anxiety and depression, (Ahern et al., 2005; Alderman et al., 2012; Du et al., 2010). However, there is an increasing recognition of the significance of factors emerging in the months and even years subsequent to flood events, potentially contributing to the development of mental health conditions. Lock et al. (2012) considered the impact of secondary stressors on the long term health of individuals affected by extreme events, such as flooding. Secondary stressors can be defined as ongoing, unresolved factors indirectly associated with a defined prior event or events, which may result in emotional strain among affected individuals and act as obstacles in a return to what is perceived as normality. The development of secondary stressors in the weeks and months in the aftermath of disasters, generate stress and anxiety by challenging the coping capacity of individuals (Ryan et al., 2014). Additionally the re-emergence of secondary stressors potentially remind victims of previous trauma, with extensive evidence demonstrating that the probability of individuals developing mental health conditions following extreme events is associated with the extremity and perseverance of secondary stressors (Overstreet et al. 2010). Flood related stressors, such as the duration of repair works following a flood event extend the timeframe before affected residents can resume normal pre-flood daily

routines, potentially prolonging any existing stress caused by the flood event (Health Protection Agency, 2011); (Ryan et al., 2014). Lock et al. (2012) identified a range of known secondary stressors that were found to have an impact on the mental health of extreme event victims. However, an important research gap is evaluating the impact of these secondary stressors specifically on flood victims and on different types of communities, for example urban and rural areas.

This research aims to provide an indication of the ongoing secondary stressors impacting urban and rural communities affected by repeated flooding and explore the potential impact on health. Achieving a greater understanding of secondary stressors will permit a more effective and co-ordinated response to promote well-being and recovery.

MATERIALS AND METHODS

Study areas

This study was carried out from November – December 2014 within three areas in Northern Ireland (Figure 1). This was to allow the inclusion of flood affected residents

Table 1. General characteristics of study participants

	Number of residents
Gender	
Male	5
Female	7
Age	
18-25	0
26-35	0
36-45	0
46-55	4
56-65	5
65+	3
Flood frequency	
Two times	8
Three times	3
Four times	1
Dates of flood events	
2014	1
2013	3
2012	7
2011	2
2010	1
2009	0
2008	1
2007	9
Pre-2007	5

living in both urban and rural areas, in order to demonstrate the full scope of secondary stressors experienced by individuals.

Research methods

The study entailed a mixed method research approach, involving a semi-structured interview and the completion of a questionnaire survey. Interviews involved the use of introducing, follow up, direct and interpreting questions to demonstrate the secondary stressors impacting residents by acquiring an account of prior flood experiences. Interviews lasted around fifteen minutes and were conducted with the head of each household in question. Subsequent questionnaire surveys allowed the collection of demographic data and permitted participants to quantify the impact of each stressor and indicate the effect of other listed secondary stressors identified through literature review. Both the interviews and surveys were piloted prior to the study with a small number of individuals from non-academic backgrounds to ensure the clarity of the questions.

Data collection

A purposive sample method was used in the study, involving selection of areas known to have experienced repeated flood events. The study only included participants affected by flooding at least twice to ensure that any additional secondary stressors experienced only by victims

of reoccurring flooding were identified. Identification of the study areas was possible via data provided by the Department of the Environment.

A total of twelve residents participated in the study, seven from an urban area and five from a rural location. The sample size was due to the small number of individuals affected in each rural study area, thus requiring the selection of two areas for the proposed research. A similar number of urban participants were thus selected to participate in order to ensure a sample size similar to the rural population.

Data analysis

Interview data was transcribed and coded using NVivo. Quantitative data analysis was conducted using the Statistical Package for the Social Sciences to generate descriptive statistics.

The use of a Likert scale in the questionnaire allowed a score to be calculated for each stressor. The score was calculated through addition of all the Likert scale answers for each stressor. For example, nine residents gave 'Loss of income' a score of 0, two residents gave it a score of 1 and finally one resident gave it a score of 3 so the Likert scale score was $0 + 2 + 3 = 5$. Thus the score allowed the identification of the secondary stressors causing the greatest impact on residents.

The questionnaire included the Impact of Event Scale (a 22-item self-report measure which assesses subjective distress caused by traumatic events). The Impact of Event score was calculated through the addition of likert scale scores for each item per participant.

RESULTS

The general characteristics of the participants are detailed in Table 1.

Secondary stressors

Analysis of the interviews involved determining both the number of references to each secondary stressor by the interview participants and the scores of each stressor in the questionnaires (Table 2). Eight additional secondary stressors arose in the interviews which had not been included in the questionnaire as they had not been identified in the literature relating to reoccurring flood events. These were: affecting lifestyle choices, being away from home when flood occurs, difficulty accessing flood defences, disruption to daily life, lack of confidence in or help from agencies, no insurance, pets being injured during flood and possible contamination.

Analysis concluded that the most frequently referenced secondary stressors by residents in the interviews were: damage to property and possessions, repair works, fear of reoccurrence and lack of confidence in or help from agencies. The first three stressors also achieved the highest

Table 2. Secondary stressors identified in the interviews

Secondary stressors	No. of references	Score of Impact
Loss of income	0	5
Debt	0	11
Difficulty obtaining flooding hardship payment	0	9
Difficulty travelling to work/school	0	9
Moving out of home permanently	1	36
Pets being injured during flood	1	*
Affecting lifestyle choices	4	*
Negative impact on family life	5	37
No insurance	5	*
Loss of property value	6	37
Difficulty obtaining insurance pay-out	7	14
Disruption to livelihood	8	19
Possible contamination	10	*
Being away from home when flood occurs	10	*
Loss of items of sentimental value	12	38
Isolation	13	17
Temporary evacuation	13	29
Renewing insurance	13	30
Difficulty accessing flood defences	14	*
Disruption to daily life	15	*
Lack of confidence in or help from agencies	35	*
Fear of reoccurrence	41	50
Repair works	50	41
Damage to property and possessions	75	43

* Stressors not previously identified in the literature on reoccurring flooding

scores in the questionnaire. However, various other stressors also received high scores in the questionnaire including: temporary evacuation, renewing insurance, moving out of home permanently, negative impact on family life, loss of property value and loss of items of sentimental value.

With regards to the four key secondary stressors, firstly, damage to property and possessions was a primary concern for residents. Loss of essential utilities including heating and damage to electrical appliances such as fridge freezers caused severe disturbance to normal routines. Flood water also caused extensive internal damage to properties, resulting in residents having to temporarily vacate their properties. Unidentified structural damage, for example potential damage to damp proof coursing caused residents apprehension regarding possible future problems such as rising damp. Rural residents were particularly affected by exterior damage as they often owned external buildings, extra vehicles etc. which were very vulnerable to flood damage. Numerous residents outlined damage to irreplaceable sentimental possessions lost during flooding such as books, tools, photographs, where the distress caused was often more significant than that caused by any other form of damage.

Secondly, repair works, including their duration and any difficulties encountered was a significant stressor for residents impacted by reoccurring flooding as their primary desire is to return to normality as quickly as possible. Duration of repair works resulted in considerable

strain, with repairs lasting in some cases up to six months or even a year to reach full completion. The disturbance associated with this lengthy duration was extreme, particularly in dwellings where the entire ground floor had been submerged in floodwater. Thus flood depth was an important factor in determining the stress associated with repair works. Additionally, continuous noise of equipment such as dehumidifiers added to the strain, causing sleep disturbance and hindering relaxation, often for weeks at a time while properties dried out. Difficulties associated with unreliable building contractors added to the burden, often increasing duration of the repair works or resulting in makeshift renovations by residents themselves. Additionally the unsatisfactory completion of repairs, for example, walls not properly sealed following a flood, sometimes increased the extent to which a property was flooded on a second occasion. The discovery of previously unknown structural damage coming to light at a later stage, such as internal dampness and underfloor damage, reignited unpleasant memories relating to the flooding for those affected. With regards to victims of repeated flooding, the repair works appear unending as the eventual completion of repairs could potentially be followed by another flood event.

Thirdly, fear of reoccurring flooding was one of the foremost stressors during the study. It was a persistent source of agitation for those affected repeatedly by flooding, as demonstrated in some of the interview quotes below.

Table 3. Impact of Event Scale scores

Score and consequence	Number of residents
Less than 24 (PTSD is not a clinical concern)	6
24 or more (PTSD is a clinical concern. Those with scores this high who do not have full PTSD will have partial PTSD or at least some of the symptoms).	2
33 and above (Represents the best cutoff for a probable diagnosis of PTSD).	0
37 or more (High enough to suppress immune system functioning even 10 years after an event).	4

Wilson and Keane (1997)

'You don't know when it's going to happen...you're waiting on it coming'.

'It's always in the back of your mind'.

The occurrence of or forecast for heavy rainfall and extreme weather intensified the anxiety for residents, acting as a reminder of previous flood experiences.

'As soon as I hear rain I could crawl into a hole...I'm a nervous wreck, especially when I hear on that television that there's rain...I live by rain'.

'It's terrible, nobody realises the worry, you're in constant worry with it because you don't know when it's going to start to rain'.

Fear of reoccurring flooding is closely associated with the realisation that there is little or nothing that can be done to stop floodwater entering the home.

'You end up completely helpless. There is nothing you can do'.

It was evident in the interviews that several of the residents in this study constantly contemplated the likely prospect of future flooding and felt that it was not something that they could face again.

'I do honestly think if I was to get flooded again I think it would finish me'.

It was apparent during the data collection of this study that many of the residents affected by flooding had taken the course of action indicated in one of the quotes above from a resident. Numerous tenants moved away at the end of their contracts and home owners, unable to sell their property due to its 'flood risk' designation, chose to rent out their properties and move elsewhere as the fear of reoccurring flooding made living there any longer an impossibility.

Fourthly, lack of action by agencies regarding flood alleviation caused anger among many residents, particularly regarding measures requiring minimum maintenance, such as regularly clearing street drains and rivers. Other difficulties included identifying and successfully contacting the responsible agency to request assistance during flood events. Difficulty accessing flood defences was a stressor closely connected to government agencies as residents stated that they were either provided with too few sandbags or issued with sandbags too late i.e. after the occurrence of the flood event. Lack of assistance

from agencies was particularly stressful for vulnerable residents, such as the elderly and those living alone, who often felt isolated by flooding and left to cope with the impacts and aftermath alone.

Impact on health

This study used two means of assessing the impact of secondary stressors on health. Firstly the Impact of Event Scale was completed by each resident. Table 3 outlines the resulting scores.

Half of the residents scored less than 24 on the Impact of Event Scale, indicating that Post-traumatic Stress Disorder (PTSD) was not a clinical concern for them. Two of the residents scored between 24 and 33 which suggests that they had at least some of the symptoms of PTSD or suffer from partial PTSD. Four of the residents scored above 37, which strongly suggests that they are likely to suffer from PTSD.

The second measure utilised to assess the impact on health involved analysing health-related words and phrases used by the interview participants. The health related terms identified in the interview are summarised in Table 4.

Outward physical symptoms and reactions associated with the flood event included direct sickness such as vomiting, diarrhoea and feeling physically ill immediately after the flood event. Potential stress related physical reactions included loss of appetite and difficulty sleeping. Strain was placed on residents during the flood event itself, by having to plead with agencies to provide flood defences. Ongoing physical behaviour included watching rising water levels. Immediate emotional reactions to flood events included panic and terror as well as ongoing emotional reactions, ranging from anger and annoyance to dread and worry. Regarding perceived health impacts of flooding, residents referred to pre-existing health conditions such as cancer, as well as health conditions which emerged post-flood, which residents suggested the stress of flooding may have contributed to, for example heart attacks.

DISCUSSION

The results demonstrate that an extensive range of

Table 4. Health related terms identified in the interviews

	Terms identified	Number of references
Outward physical symptoms and reactions	Diarrhoea	1
	Vomiting	1
	Sick	1
	Sleep/sleeping	3
	Eating	1
	Plead	1
	Watch/watches	1
Emotional reactions (Immediate and ongoing)	Anger/angry	3
	Annoyed/annoying	3
	Dread	1
	Feel/feeling	5
	Nervous	1
	Panic/panicking	5
	Scared/scary	5
	Shock/shocked	3
	Stress/stressed/stressful	8
	Terrified/terrifying	2
	Upset	1
	Waiting	1
	Worry/worried/worrying	11
Perceived impact on health/Health conditions	Health	2
	Cancer	1
	Heart	2

secondary stressors are experienced by flood victims following the occurrence of a flood event. These stressors include economic stressors such as difficulties associated with compensation and social stressors including the impact on lifestyle choices, as well as numerous additional stressors, validating the findings of Lock et al. (2012). However, this study added to existing research by both developing the understanding of some previously identified stressors and also by identifying several additional stressors. For example, regarding damage to property and possessions, the findings indicated not only the worry associated with repair works, but also apprehension relating to possible unidentified structural damage. An example of an additional stressor identified by this study is concern regarding possible injury to pets during floods, which places extra stress on residents, often limiting the distance residents travel from home during heavy rain, thus hindering leisure activities.

A clear finding of this study was that flood victims are affected by multiple stressors simultaneously, as the aftermath of a flood event requires the resolution of a wide range of issues including conducting repair works, as well as the emotional strain of losing treasured possessions and temporarily moving out of the home. Therefore the importance of the expedient resolution of issues such as insurance claims and securing reputable building contractors to commence repairs within a reasonable timescale cannot be underestimated as it minimises the extent of stress placed on flood victims.

Secondary stressors associated with repeated flood

events do not have a known timescale but are rather a persistent problem (Overstreet et al., 2010). Despite the most recent flood event experienced by residents in this study ranging from one to seven years prior to the study, all participants continued to experience secondary stressors and expressed fear of potential future flooding. However, this study demonstrated that individuals react differently to stressors, with some choosing to move elsewhere to avoid future flood risk while others resolutely refused to abandon their home. An additional issue noted in this study is that government agencies, whose predominant role in relation to flooding is to alleviate problems, often actually cause additional stress to residents due to lack of clarity regarding flood responsibilities and poor response during flood events. Furthermore, governmental post-flood support is often strongly criticised. Residents are thus left to deal with the emerging secondary stressors alone, which is particularly detrimental for individuals who live alone. A resulting repercussion is lack of trust between residents and the agencies and the reluctance of residents to become involved in local flood resilience schemes.

Lock et al. (2012) emphasised the importance of recognising the potential contribution of secondary stressors to mental health conditions and the results of this study clearly convey potential health implications for victims of repeated flood events which necessitate further study. The indication by the Impact of Event scores that four of the participants, within a small sample size, were likely to be suffering from PTSD demonstrates the need to develop this area of research. Numerous previous studies

have found a high prevalence of PTSD among flood victims in the aftermath of a flood event (Carroll et al., 2010; Heo et al., 2008; Liu et al., 2006; Mason et al., 2010; Norris et al., 2004; Paranjothy et al., 2011), however, further work is necessary in relation to identifying the particular secondary stressors which are more likely to contribute to PTSD.

The analysis of the health related terms used by residents indicates that even those for whom PTSD is not a clinical concern may experience extreme stress due to flood experience. Table 3 demonstrates that the majority of the stress is not manifested in outward physical symptoms and reactions but rather leads to emotional reactions, both immediate and ongoing, which many residents may try to ignore or hide for the sake of their family, potentially leading to health implications at a later stage. Additionally the interviews found that residents often perceive flooding to exacerbate pre-existing health problems such as asthma, while others strongly believed that the stress caused by flood events contributed to previously undiagnosed health conditions, including heart attacks.

This study has several limitations. Firstly, some of the flood victims had last been affected by flooding seven years ago, resulting in memory restrictions. Additionally it was not possible to reach the numerous flood victims who moved away following repeated flood experience. It is possible these individuals may have moved due to being impacted by secondary stressors to an even greater extent than those who remained and thus found themselves unable to cope, which would have made them a valuable inclusion in the study.

CONCLUSION

The results of this study add to the existing research available regarding the long term health implications of flood events. It provides additional evidence that flood related secondary stressors may emerge, particularly for residents affected by reoccurring flood events. A greater understanding of secondary stressors will significantly contribute to the development of more effective flood response networks by agencies and the implementation of adequate post flood support to affected residents.

Although the study provided an indication of stressors affecting residents living in both urban and rural locations, an ongoing further quantitative study should attempt to quantify whether communities with different geographical locations experience similar stressors. It is essential to confirm which secondary stressors have the most detrimental impact on residents, as they are the stressors most likely to contribute to health conditions and may require governmental or social support to resolve.

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